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Surgical techniques on periodontal plastic surgery and soft tissue regeneration: Consensus report of Group 3 of the 10th European Workshop on Periodontology

Sanz, Mariano ; Simion, Massimo ; Working Group 3 of the European Workshop on Periodontology

Abstract: BACKGROUND: The scope was to review the three main clinical indications in periodontal plastic surgical procedures. AIMS: To review the fundamental principles in periodontal plastic surgery, the main surgical designs in flap surgery applied to the treatment of recessions, peri-implant soft tissue deficiencies and soft tissue ridge augmentation, as well as the surgical principles of using autologous connective tissue grafts and soft tissue substitutes. FUNDAMENTAL PRINCIPLES IN PLASTIC SURGERY: In the pre-operative phase, the key elements are the control of prognostic factors affecting the patient, namely oral hygiene, tobacco smoking cessation and systemic disease control. In the operative phase, the principles of flap design, mobilization, advancement, adaptation and stabilization. In the post-operative phase infection control, including effective oral hygiene measures, antiseptic treatment and other medications. CRITICAL ELEMENTS IN FLAP DESIGN AND SURGICAL EXECUTION: In single recession defects, the most widely used flap technique is the coronally advanced flap and in specific clinical situations the laterally positioned flap. In multiple recession defects, the number of defects and their location and depth guide the surgical design, being one design with and the other without vertical releasing incisions. When flaps are used in combination with grafts the tunnel flap is also used extensively. CRITICAL ELEMENTS IN THE USE OF SOFT TISSUE REPLACEMENT GRAFTS: The key elements are the donor site selection and harvesting technique, its tissue integration and volume stability. CLINICAL RECOMMENDATIONS: Given the current evidence, various clinical recommendations on the use of flaps and grafts are provided.

DOI: <https://doi.org/10.1111/jcpe.12215>

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ZORA URL: <https://doi.org/10.5167/uzh-108001>

Journal Article

Accepted Version

Originally published at:

Sanz, Mariano; Simion, Massimo; Working Group 3 of the European Workshop on Periodontology (2014). Surgical techniques on periodontal plastic surgery and soft tissue regeneration: Consensus report of Group 3 of the 10th European Workshop on Periodontology. Journal of Clinical Periodontology, 41 Suppl:92-97.

DOI: <https://doi.org/10.1111/jcpe.12215>



Surgical Techniques on Periodontal Plastic Surgery and Soft Tissue Regeneration. Consensus report of working group 3

Journal:	<i>Journal of Clinical Periodontology</i>
Manuscript ID:	CPE-11-13-4778
Manuscript Type:	Supplement Article
Date Submitted by the Author:	19-Nov-2013
Complete List of Authors:	Sanz, Mariano; Universidad Complutense de Madrid, Periodoncia Simion, Massimo; University of Milan, Periodontology; Studio Simion, Implant
Topic:	Treatment
Keywords:	Periodontal disease
Main Methodology:	Other

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**Surgical Techniques on Periodontal Plastic Surgery and Soft Tissue
Regeneration. Consensus report of working group 3**

Mariano Sanz¹ & Massimo Simion²

- 1. University Complutense of Madrid (Spain)
- 2. University of Milano (Italy)

On Behalf of Working Group 3:

Frank Abbas (NL)	Virginie Monnet-Corti (F)
Sofia Aroca (F)	Alberto Ortiz-Vigon (E)
Zvi Artzi (ISR)	Giulio Rasperini (I)
Rino Burkhardt (CH)	Massimo de Sanctis (I)
Pierpaolo Cortellini (I)	Ignacio Sanz-Sanchez (E)
Korkud Demirel (TR)	Alberto Sicilia (E)
Moshe Goldstein (ISR)	Istvan Urban (H)
Kay Horsch (CH, Osteology)	Selcuk Yilmaz (TR)
Markus Hürzeler (D)	Ion Zabalegui (E)
Niklaus P. Lang (CH,HK)	Otto Zuhr (D)

Conflict of Interest:

XXX

Abstract

Background: The scope was to review the three main clinical indications in periodontal plastic surgical procedures

Aims: To review the fundamental principles in periodontal plastic surgery, the main surgical designs in flap surgery applied to the treatment of recessions, peri-implant soft tissue deficiencies and soft tissue ridge augmentation, as well as the surgical principles of using autologous connective tissue grafts and soft tissue substitutes

Fundamental principles in plastic surgery: In the preoperative phase the key elements are the control of prognostic factors affecting the patient, namely oral hygiene, tobacco smoking cessation and systemic disease control. In the operative phase, the principles of flap design, mobilisation, advancement, adaptation and stabilization. In the postoperative phase infection control, including effective oral hygiene measures, antiseptic treatment and other medications

Critical elements in flap design and surgical execution: In single recession defects, the most widely used flap technique is the Coronally Advanced Flap (CAF) and in specific clinical situations the Laterally Positioned Flap (LPF). In multiple recession defects, the number of defects and their location and depth guide the surgical design, being one design with and the other without vertical releasing incisions. When flaps are used in combination with grafts the tunnel flap is also used extensively.

Critical elements in the use of soft tissue replacement grafts. The key elements are: the donor site selection and harvesting technique, its tissue integration and volume stability.

Clinical Recommendations: Given the current evidence, various clinical recommendations on the use of flaps and grafts are provided

Key words: *periodontal plastic surgery, surgical designs, recessions, periimplant deficiencies, connective tissue grafts, soft tissue substitutes*

Introduction

According to the Proceedings of the World Workshop in Periodontics (1996) : “*Periodontal (and peri-implant) plastic surgery encompasses the surgical procedures performed to prevent or correct anatomical, developmental, traumatic or disease-induced defects of the masticatory mucosa (gingiva), lining mucosa (alveolar mucosa) or bone*”. Based on these proceedings, the scope of this Workshop group 3, however, was restricted to the three main indications in current clinical practice: recession treatment at teeth and/or soft tissue deficiencies treatment at implant sites and soft tissue ridge augmentation associated with implants or fixed dental prosthesis.

The objective of this consensus report is to review the fundamental principles in periodontal plastic surgery, the main surgical designs in flap surgery applied to the treatment of recessions, peri-implant soft tissue deficiencies and soft tissue ridge augmentation, as well as the surgical principles of using autologous connective tissue grafts and soft tissue substitutes

Fundamental principles in periodontal plastic surgery

The basic principles in periodontal flap surgery have to be observed pre-operatively, during the intervention and post-operatively (Burkhardt & Lang 2014).

In the *Pre-Operative Phase* the key elements are:

- *The Impact of Oral Hygiene and Infection Control.* The role of an infection-free oral cavity and hence, a plaque free dentition have been demonstrated to be the key prerequisites for optimal outcomes of periodontal surgical procedures. Consequently, individually optimal standards of biofilm control and professional cause-related therapy have to precede the surgical intervention. In light of the etiological impact of traumatic tooth brushing on the formation of recessions appropriate preventive measures have to be implemented.
- *The Impact of adverse habits: Tobacco Smoking*

It has been recognized that heavy (≥ 20 cigarettes /day) smoking negatively affects surgical treatment outcomes. Moreover, a dose-dependent negative influence has been demonstrated in recession coverage. Hence, smoking cessation counselling prior to plastic surgical interventions is strongly recommended. It has to be realized, however, that

successful smoking cessation may require several months to years to result in a positive impact. Therefore, smoking cessation should be implemented as early as possible. Moreover, it has to be realized that inadequate biofilm control and smoking have been shown to have synergistic negative effects.

- *Impact of impaired health (Systemic Diseases)*

As for any surgical procedure, systemic conditions such as *diabetes mellitus* may have a severe negative effect on wound healing, whereby infection may jeopardize the outcome. Also, the degree of diabetic control as expressed by the level of HbA1C and the duration of experienced diabetes may have a dose-dependent impact. Consequently, it is advisable to consult with the patient's diabetologist and to request a documentation of the HbA1C level prior to the surgical intervention. Furthermore, the issue of a very low infective burden in the oral cavity cannot be neglected.

In the *Operative Phase* the key elements are:

- *Flap Design*

Flap design depends on the quantity and quality of masticatory mucosal tissues and their vascularity. In this respect, flap design represents a three-dimensional issue, and the wound bed and the flap tissue are interdependent. The better the vascularity (number of vessels and diameter) of the tissue sources, the better are the healing outcomes. Moreover, the less traumatic the intervention, the better healing outcomes are to be expected. Whenever possible, *minimally invasive surgical approaches* should be implemented, which encompasses a diligent, precise and least traumatic surgical management of the tissues to reach the interventional objectives. Furthermore, magnification, bright and focused illumination, appropriate instruments and materials are essential to achieve this goal.

It is advisable to reduce the number of or avoid releasing incisions. Moreover, the maintenance of the thickness of the masticatory mucosa needed must be a primary objective.

- *Flap Mobilisation and Advancement*

Whenever an advancement of a flap is needed, additional measures for achieving flap mobility are indicated. Periosteal releasing incisions and further splitting the flap apically to the mucogingival line have to be performed. The apical extension of the incision, however, should avoid the incorporation of muscle tissue into the flap. In many instances, however, the periosteal releasing incision may sufficiently increase flap mobility.

- *Flap adaptation and stabilisation*

A thin blood clot adhering to the vascularised or non-vascularized wound bed is of utmost importance to achieve optimal healing outcomes. The stability of the clot and its adherence is crucial to withstand disruptive forces on hard non-shedding surfaces.

A flap with minimum tension positioned onto the wound bed resulting in passivity of the flap is a prerequisite for clot stability. The latter has to be assured by applying adequate suturing technique. This, in turn, means that a flap once placed in its final position should not retract upon minimal, physiological movement of the lips or cheeks before suturing. Final flap stability by suturing is dependent also on the selection of the anchoring points.

In the *Post-Operative Phase* the key elements are:

- *Post-operative instructions*

Postoperative, preferably written instructions should be given to the patient including an explanation concerning all medications, potential discomfort and possible complications as well as diet modifications required and where to call if adverse events occur or questions arise.

- *Wound healing resistance to infection*

It has been repeatedly demonstrated that optimal outcomes of periodontal plastic surgical procedures depend on an effective post surgical biofilm control during the entire healing period. In essence, to reach a status of homeostasis, a period of 4 to 8 weeks has to be considered during which regular checks should verify the patients' ability to perform optimal biofilm control. Mechanical interference of the surgical areas should be avoided during early phases of healing, what necessitates the application of antiseptics during this period.

Moreover, the application of periodontal dressings on the recipient sites in periodontal plastic surgery is contraindicated.

- *Effective antiseptic treatment*

In order to satisfy the principle of complete chemical plaque control following surgery, only antiseptics with high substantivity are appropriate and hence, a 0.12 % or 0.2 % chlorhexidine digluconate are recommended. Chemical plaque control should be supplemental, not a substitution of a modified mechanical biofilm removal. This is especially important during the first post-surgical weeks, when mechanical impacts to the surgical sites should be avoided.

- *Effective oral hygiene programs*

Mechanical biofilm removal is to be started after periodontal plastic surgical interventions as early as possible, but should avoid trauma to the surgical sites. Hence, ultra-soft toothbrushes soaked in antiseptic solutions should be used after suture removal. These brushes may be replaced with a soft brush after an additional 2 weeks.

- *Wound infections; role of sutures*

Suturing with low tension and using delicate sutures best maintain the clot and flap stabilisation. Suturing may, however, impinge on the microcirculation of flaps and sutures may collect biofilms and promote tissue inflammation, what may jeopardize optimal wound healing. Sutures usually provide their function within the first 3 to 4 days post-surgery. Consequently, sutures should remain as short as needed to assure stability in the early healing phase. From a clinical point of view, diligent removal of the sutures between one-two weeks should be recommended depending on the type of intervention and expected healing.

- *Medications*

In periodontal plastic surgery, the administration of peri- or post-surgical systemic antibiotics, are generally not indicated, although depending on the extent of the surgical procedure and mainly when treating deficiencies at infected implant sites the administration of systemic or local antibiotics may be indicated. Conventional non-steroidal anti-inflammatory drugs (NSAIDs) have been widely used to control postoperative pain. They are proven to be

effective, tolerated by patients, easy to administer and have an acceptable potential for interaction with other systemic drugs.

Critical elements in flap design and surgical execution

The selection of a flap as the surgical technique of choice to treat soft tissue recessions around teeth will depend on local anatomic characteristics, on the patient’s aesthetic requirements and the surgeon preferences.

These essential anatomical characteristics are: the tooth location, the number of recession defects (multiple or single), the interdental attachment level (Miller Class), the amount and thickness of keratinized tissue (KT) apical or lateral to the recession, the vestibular depth and the size, height and width of the recession defect (De Sanctis & Clementini 2014).

In single recession defects, the most widely used flap technique is the Coronally Advanced Flap (CAF), although in specific clinical situations the Laterally Positioned Flap (LPF) can also be considered. The most widely utilized CAF design is a trapezoidal flap consisting on two vertical-oblique incisions connected with a coronal incision through the sulcus. The location and shape of the coronal incision depends on the depth of the recession and should be extended to the anatomical papilla.

When the amount and thickness of KT apical to the recession is unfavourable, the LPF is recommended if there is an adequate amount KT lateral to the recession. Its design consists on two parallel vertical incisions and a connecting submarginal horizontal incision maintaining enough attached gingiva in the donor site to prevent secondary recession.

In multiple recession defects, the number of defects and their location and depth affect the surgical design. There are two possible different approaches one with and the other without

vertical releasing incisions. When the size of the multiple recessions is rather even or the deepest recession is in the centre of the surgical area, representing the centre of rotation, the application of a flap without vertical releasing incision (s) is recommended. The needed mobility of this flap is achieved by the horizontal extension of the incision, allowing the advancement of the flap to achieve full coverage of all the recessions. When the depth of the multiple recessions is uneven or when the deepest recession is located at the edges of the surgical area, vertical (s) releasing incision (s) are needed.

In these designs the flap should be elevated using a combination of split and full thickness dissection with the purpose to allow the full thickness of the flap component, including the periosteum, over the avascular tooth surface.

The root should be mechanically debrided to allow a de-contaminated smooth surface. The use of chemical conditioning has not demonstrated an additional clinical value.

The use of enamel matrix derivatives (EMD) as a biological agent has shown a significantly increased percentage of root coverage and increased attachment levels when compared with CAF alone in single recession defects. The use of other biological agents (ex. platelet aggregates) has failed to demonstrate a significant clinical added value.

To properly advance the flap its passivity should be assured by split thickness dissection beyond the mucogingival junction detaching the base of the flap from the periosteum. In some instances it is recommended to perform a further superficial dissection to separate the flap from the muscle.

The flap should be located in a position coronal to the CEJ, completely passive and tension free.

Sutures must assure the stability of the flap in this position.

In the treatment of multiple recession defects, the tunnel flap has also been described and it is used extensively. All the available evidence, however, on the efficacy of this surgical design lies within the combined application of a soft tissue replacement graft. This technique consists of an intra-sulcular incision, a full thickness flap elevation beyond the mucogingival junction and a further split thickness dissection of the periosteum. The flap elevation must be continued horizontally underneath the buccal papilla connecting the sulcular incisions from adjacent teeth. The buccal aspect of papilla is elevated but not disconnected from its lingual aspect. The graft should be incorporated and stabilized in this surgically created tunnel with the use of specific suturing techniques. Moreover, the flap can be advanced to fully cover the graft also using specific suturing techniques

There is no evidence on the efficacy of the advanced flap on the treatment of soft tissue deficiencies around implant supported restorations, since the scarce evidence available is limited to the combined use of advanced flaps and soft tissue replacement grafts. Furthermore, the evidence from the treatment of recessions around teeth cannot be extrapolated to deficiencies around implant-supported restorations since the anatomical characteristics of the soft tissues around dental implants are different.

Clinical Recommendations

The most effective use of coronally or laterally advanced flaps (complete root coverage) can be considered when the following circumstances are met:

- Tooth location, since most of evidence is derived from maxillary anterior teeth
- Normal tooth position in relation to the adjacent teeth
- Integrity of the adjacent bone height and periodontal attachment level

- Presence of adequate height and thickness of keratinized tissue
- Absence of non-carious cervical lesions invading the CEJ or the presence of deep root deficiencies.
- A healthy non-smoker patient with proven oral hygiene efficacy, both in terms of plaque control and absence of gingival trauma.
- An operator with demonstrated surgical skills and expertise

Critical elements in the use of soft tissue replacement grafts

Soft tissue replacement grafts have become a substantial element in plastic periodontal and implant surgical procedures for clinical indications such as treatment of recessions and peri-implant soft tissue deficiencies, as well as soft tissue ridge augmentation. The critical elements on the use of soft tissue replacement grafts are: the donor site selection and harvesting technique, together with the graft tissue integration and its volume stability (Zuhr, Bäumer & Hürzeler 2014)

- Donor Site Selection and Harvesting Technique

When using autologous grafts, there are different donor sites that can be selected, but mainly subepithelial connective tissue grafts (SCTGs) are harvested from the palatal mucosa. Moreover, there are varying harvesting techniques resulting in different graft characteristics, both in terms of size and histological composition. SCTGs from the posterior palate are usually denser but limited in size, while SCTGs from the anterior palate are of looser consistency, but can be more extensive.

A sound knowledge of the anatomy of the palate is essential when harvesting a SCTGs in order to prevent complications. Due to the individual variability in the course of the palatal

neurovascular bundle, extra-care should be taken especially if SCTGs are harvested from the molar area. The preoperative location of the great palatal foramen and the clinical evaluation of the palatal soft tissue thickness are imperative in each individual case.

Clinical experience recommends harvesting SCTGs from the posterior palate when better volume stability over time is desired, such as in soft tissue augmentation procedures. On the other hand this type of graft seems to be more sensitive to the local blood supply for its revascularization.

There are several harvesting techniques for SCTGs described in the literature, but the most frequently reported are the single incision technique at the anterior palate, the trap door approach at the posterior palate and the distal wedge technique when harvesting SCTGs from the tuberosity area. Additionally FGG can be harvested and de-epithelialized extra-orally. Each procedure has advantages and disadvantages and the choice depends on existing anatomical limitations, the goal of the procedure, the expected morbidity and the surgeon's expertise.

- *Tissue Integration and Volume Stability*

The survival of SCTGs depends on plasmatic circulation and the graft subsequent revascularization. For this reason, it is desirable to facilitate the best possible blood supply both from the recipient bed and the overlying flap. Furthermore, it is important to assure the graft immobilization, the intimate contact between the graft, the recipient bed and the overlying flap and the tension free flap closure with the use of appropriate suturing techniques.

The application of minimally invasive principles based on precise and least traumatic soft tissue handling has been demonstrated to improve treatment outcomes.

Although SCTGs can survive even with small parts of the grafts being exposed to the oral cavity, care should be taken to completely cover SCTGs, especially if they are placed on avascular surfaces. There is no evidence that the use of autologous plasma rich in growth

factors (PRGF) or platelet rich plasma (PRP) in conjunction with SCTG provides additional benefit.

When SCTGs are interposed between the root surface and flap, the attachment between the graft and the previously exposed root surfaces predominantly occurs by a long junctional epithelium. There is no evidence that the use of chemical root conditioning agents provides any additional benefit in this healing event. Whether or not the combination of SCTG and enamel matrix derivate can influence the type of attachment on the root surface, it is presently unclear and needs further scientific verification.

When SCTGs are placed over composite restorations, there is limited short-term data indicating successful clinical outcomes in the treatment of recessions.

When SCTGs are placed on implant supported restorations in the treatment of soft tissue deficiencies variable clinical outcomes have been reported.

SCTGs can be used successfully for soft tissue augmentation in partially edentulous ridges. In these indications the SCTGs are placed on vascular beds where uneventful and favourable wound healing processes can be expected. However the volumetric aspects have hardly been evaluated in the literature.

Soft Tissue Substitutes

The limited amount of autologous donor tissue and the increased patient morbidity are substantial disadvantages of SCTGs. For this reason, the search for suitable soft tissue substitutes is currently in the centre of interest of scientists and manufacturers.

Allogenic, xenogenic and alloplastic materials are currently commercially available, but only few have reported scientific documentation. These materials have different structures, composition and therefore, require specific surgical manipulation. When used for root coverage and soft tissue volume augmentations, it is generally accepted to fully cover these materials.

Considerations for Future Research

After reviewing the current literature the group identified the need of:

- Clinical trials to compare different flap designs
- Well-established clinical and patient-reported outcome variables that reflect the efficacy of these surgical interventions
- Long-term information (at least 5 years) on the stability of these surgical interventions.
- The use of 3D image based technologies to improve the flap designs
- Understanding the healing characteristics and long term volume stability of SCTGs harvested with different techniques and from different areas of the palate
- Understanding the biological effects of SCTGs in different clinical indications
- Understanding the possible effect of combining SCTGs with bioactive substances
- Understanding the healing of SCTGs placed on restored teeth and implant supported restorations
- Understanding the biological mechanisms and the clinical potential of currently available and new generation soft tissue substitutes using tissue engineering principles

References

Burkhardt R., Lang N.P. (2014) Fundamental principles in periodontal plastic surgery and mucosal augmentation - a narrative review. *Journal of Clinical Periodontology* **41**: Supplementum

De Sanctis M., Clementini M. (2014) Flap approaches in plastic periodontal and implant surgery: critical elements in design and execution. *Journal of Clinical Periodontology* **41**: Supplementum

Zuhr O., Bäumer D., Hürzeler M.B. (2014) The addition of soft tissue replacement grafts in plastic periodontal and implant surgery: critical elements in design and execution. *Journal of Clinical Periodontology* **41**: Supplementum



Figure 1
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